3 THEORETICAL FRAMEWORK

3.1 Introduction

In order to estimate the demand and value of the non-market goods, economists have suggested two common methods, namely the indirect or travel cost method (TCM) and the direct or contingent valuation method (CVM) (Layman, Boyce and Criddle, 1996). However, economists have discovered that neither the two methods could produce the best measurement of valuation. Each has its own pros and cons. In order to overcome this problem, economists decided to introduce a new method by using a combination of both methods known as 'Hypothetical Travel Cost Method' (HTCM) (Cameron, 1992; Layman, Boyce and Criddle, 1996).

In the TCM, respondents will be asked to inform their actual behavior during the visit such as their expenses, time consumption and facilities used. Rather than CVM, it requires the respondents to report the value of benefits they will obtain from their behavior in the visit. For example, the amount of money the respondents are willing to pay to preserve the visited place. Looking at these two methods, CVM will be used if there exist less market involvement in the consumption of resources. In other words, it is more appropriate to use CVM when dealing with a small number of respondents (Hanley and Spash, 1993).

Result accuracy obtained by the CVM is often questionable. However, the advantage of the CVM is that it allows respondents to aggregate the various types of benefits of a site (non-user value as well as user value). But whether the public is sufficiently educated to properly estimate some categories of non-user value (ecological value, for example) are still ambiguous. Since the condition is not conducive for CVM, a construction using the TCM is applied for this study.

3.2 Travel Cost Method

The TCM is a means of determining value figures for things which are generally not bought or sold, and therefore fall outside of the market's pricing system and recreational resources (value of parks, lakes and similar public areas which host a good deal of recreational activities).

Initially, the TCM was proposed by Harold Hotteling to the director of US Park Services in 1947, but was formally introduced to literature by Clawson and Knetsh (1966). At an early stage, it was known as the Clawson and Knetsch approach (Hanley and Spash, 1993) or Hotelling-Clawson-Knetsch approach (Cesario, 1976).

From then on, the studies were improved and made more common by later researchers (Dobbs, 1993; Layman, Boyce and Criddle, 1996; Fix and Loomis, 1998; Dharmaratne and Brathwaite, 1998). In the context of Malaysia, the first study took place in early 1990s (Ahmad Shuib, 1991; Ahmad Shuib and Nik

Mustapha, 1991; Nik Mustapha, 1993; Redzuan, 1999; Mohd Shahwahid, 1999; and Norlida and Jamal, 2000).

Philosophically, the TCM falls into the general category of neo-classical welfare economics; which assumes that individuals maximize their utility subject to a certain constraint. Following the law of demand assumption, the basic premise of the TCM is that the number of trips to the recreation site will be reduced with increases in distance for traveling, *ceteris paribus*. The number of visits serves as a quantity variable while the price paid by visitors acts as a proxy for prices. In order for travel cost to be a proxy for prices, the assumption on the visitors is on the single trip and single purpose.

3.2.1 Trip Generating Function (TGF)

a. Introduction

The first step involves with TCM is the formation of a trip generating function (TGF). In an actual TCM study, this stage cannot take place before the contents of TGF is determined. TGF is a function to determine the visit per individual or visit per zone, which is explained by other variables.

The purpose of TGF is to provide a model of site use. The independent variables of this TGF describes the costs of travel, including the time and on-site cost along with petrol. There is no fixed formula to determine the independent variables to be included in the model as long as it explains the visitors' decision to visit the site.

b. Independant Variables of TGF

(i) Cost (C)

Visitation rate will measure how frequent the visitor visits the park on a particular time. Normally, in terms of TCM, the period refers to the previous year visitation rate from the effective date of survey. Dealing with cost for TCM, economists had faced several challenges to determine the cost of consuming; what cost should be included, what is the opportunity cost of time, rate of cost calculation being used and apportion cost to multipurpose trips (Hanley and Spash, 1993; Redzuan, 1999; Mohd. Shahwahid, 1999).

Since there is no consensus toward this matter, an alternative model which involves different types of costs is formulated and used to generate the cost function (Redzuan Othman, 1999; Mohd. Shahwahid, 1999). For this study, it is believed that the cost function (C) of the visitors 'i' to site 'j' should consist of three different components; distance costs (DC), time costs (TC) and on-site costs (OC)

which includes the charged fee and food expenses. But the variation of these costs will be tested separately according to its suitability.

The cost function can be stated as below:

$$C_{ij} = f(DC_{ij}, TC_{ij}, OC_{ij})$$

Distance Cost (DC)

The distance cost (DC) refers to the starting point of the journey to the designated location plus the consideration of the cost per km. Distance cost can also be known as the tangible cost. The tangible cost refers to the cost of petrol or the full cost of the vehicle. The cost of petrol will definitely depend on the distance of travel. It is considered as a marginal cost since the increase in the distance of travel, will increase the cost of petrol. Whereas the full cost of the transportation consist of variety of costs such as car insurance, road tax and car maintenance.

There are two ways to measure the distance of visitors, which are from the "origin" accommodation or from the "current" accommodation (e.g. hotel). Before using the suitable method to calculate the distance, the type of visitors must first be determined. If the visitor is on a single purpose trip, it is proper to use the origin accommodation. If the visitor is on the multi-purpose trip, the current

accommodation will be used. A mismatch between the type of visitors and type of accommodation will lead to overestimation of the distance.

In order to avoid the problem of overestimation, the method suggests the usage of four (4) different approaches. The first approach is by using the distance from the visitor's "current" accommodation rather than "permanent" accommodation (McConnel, 1977). The second approach is to use the application of weighted preferences (Hanley and Spash, 1993).

Respondents will be given options to state their percentage of preferences to visit the site. For example, if a visitor's permanent accommodation is 200 km away, then the respondent will state of about five percent (5%) of willingness to visit the site. The distance will be calculated by multiplying five percent (5%) out of 200 km. As a result, the DC is 10km for the respondent.

The third approach is by using trip-type dummy variable among the explanatory variable. Dummy variable is used if someone was taking part in an extended trip, a day trip or just stopping in as part of a multi-purpose trip. The fourth approach is by creating a new model as an alternative to the standard TCM, where the numbers of days at the recreation (park) are taken as dependent variables. When this new dependant variable is used, the cost will consist of fixed costs (charged fee and fuel cost) plus daily costs (food and activities) per day (Bell, Frederick and Leeworthy, 1990).

e Cost (TC)

e cost or intangible cost consist of; (1) involves the time taken from the starting t to the park, (2) the value for the individual time during travelling and (3) time t at the recreation park. In putting the value for the individual time, the use of wage rate has been recommended (Fix and Loomis, 1998; Ahmad Shuib, 1991; ley and Spash, 1993), (if the visits took place on working days) and the use of one activities because of the visits, are the most popular measurements. One esting question is whether these values should differ between travel time and ite time?

rder to value an individual's opportunity time cost, either for travelling or on-time, two different approaches were used. The first approach will look upon the genous factor as proposed by Cesario (1976). In another application, it will ider the endogenous factor suggested by McConnel and Strand (1981).

urio (1976) has suggested using one third[9] of hourly wage rate for adult and set 5 percent of the adult value for children. Meanwhile McConnell and Strand 1) attempts to simulate the process by choosing the value that maximizes the anatory power *(r-squared)* of the Trip Generating Function (TGF).

[9] value of one third is arbitrary which is compared to the UK rate. Since the empirical result ned is higher in US than those in UK. Hence, the value of one third was chosen because UK one-fourth of the wage rate

By using the McConnel and Strand's suggestions, the opportunity cost of time (travelling or on-site) will be determined based on the ratio of income per hour multiplied by time-spent coefficient and the travel cost coefficient (see below).

$$\ln V = \alpha_1 + \alpha_2 TC + \alpha_3 Ty + ... + \alpha_i X_j + \varepsilon_i$$

where:

V is trips taken last year
TC is travel cost
Ty is time spent in hours multiplied by income per hour
$\alpha_{1....i}$ is coefficient of variable
X_i are other explanatory variables
ε_i is error term

The ratio coefficients $\partial Ty / \partial TC$, ' k ', is used as an estimation of the fraction of income that is the loss while travelling to the site or on-site time. But the value of 'k' has raised a significant challenge from other economists as done by Smith et al. (1983).

"... McConnel and Strand's 'k' proportion as a hypothesis and found estimates of an individual's opportunity cost of time based on this hypothesis to be unreliable" (Shaw, 1992:110).

The continuation of McConnell and Strand's hypothesis, Ward (1983) has proposed some adjustments on opportunity cost in the demand model. Since the 'k' depends on average wage rate, it is not applicable to measure the non-market wage visitors. Non-market wage visitors can be referred to respondents who are not earning any salary such as students, housewives and unemployed.

No doubt that, income is a major determinant of the marginal opportunity cost. In the case of sample visitors, there are two (2) types of visitors; employed and unemployed visitors. For the employed visitors, marginal opportunity cost depends on their income and their opportunity time cost. However, for the unemployed marginal opportunity cost can only be measured by the opportunity time cost (forgone benefits of travel time or on site time) for they do not receive any type of income. For example, the students forgone benefits are studying or having discussions. As a solution, Ward (1983) has divided the calculation of marginal opportunity cost into two (2) parts; income plus opportunity time cost and opportunity time cost only (forgone benefits of travel time and on site time).

In order to calculate the opportunity time cost, it must use the market wage rate because there is no standard data for all level of income. Questions arising here are: how to value the non-market wage respondents and does the respondents have constant preferences towards recreational parks? By assuming the visitor has constant preferences *per se*, the value of time on non-market wage visitors could also be referred to their parents or spouse's income.

Travel time and travel distance is congruent. If travel distance increases, then the travel time will also increase. This would create a problem of multicollinearity. Since there is a high correlation between travel time and travel distance, it is important to distinguish time into two different parts; value of time and cost of time. Both parts will have an effect on the opportunity time cost. Value of time is

when what the respondents gain from activities is greater than the benefits from the forgone activities. But the cost of time, is when what the respondents gain from activities is less than the benefits from the forgone activities.

Since the problems of multicollinearity between time travelling and travel distance is inevitably, the researcher must choose either to take the time spent in the park or the travelling time use for the visit. However this depends on two circumstances. Firstly is to use time spent in the park if the visitors are staying near the area. Secondly, is to use time travelling if the visitors are provided with a tour guide. Consequently, this study uses time spent at the park since the majority of visitors come from near by areas.

Shaw (1992) has suggested that the level of satisfaction that the visitors get from visiting the park will determined whether the time spent in the park is considered as cost or a benefit. If the visitors were satisfied, then the visit is considered a benefit. If the visitors were not satisfied, then the visit is considered a cost.

Because of the ambiguities, Freeman (1993) has suggested dropping out the utility derived from the travelling time. But the value of consumer surplus may be understated because of this failure. In his study on Pulau Langkawi, Ahmad Shuib (1991) showed that the benefits of outdoors recreation are RM425.41 per visit when considering the time in travel to Pulau Langkawi. But the result was reduced to RM351.57 per visit when the time in travel was omitted.

On-site Cost (OC)

On-site costs are expenses used for food, activities, charged fee and other facilities at the park. This cost can also be considered as monetary expenses at the park. There was no disagreement for this cost since this cost was given directly by the respondents.

(ii) Substitutes Sites

Several studies were conducted to reveal the effect of substitute sites when measurements on consumer surplus took place. The importance of incorporating information concerning substitute sites into the TGF is quite straightforward; if residents of one area have close access to a high number of substitute sites, while residents of another region do not, the demand for the site in question will be affected. But the treatment of substitute sites appears to be omitted in the most basic models.

Biases To Welfare Estimation

A biased[10] result on consumer surpluses can occur when the substitute sites are omitted from the recreation demand model (Gum and Martin, 1975; Kling, 1989; and McKean and Revier, 1990). In this context of biases, Kling (1989) has divided the bias to welfare estimation into three different parts, namely (1) when the

omitted substitute price is uncorrelated with the included variables; (2) when the omitted substitute price is perfectly correlated with own price variable; and (3) quality change when substitutes are omitted.

Rosenthal (1987) also developed three different types of TCM on his study of U.S. Army Corps of Engineer reservoirs in Kansas and Missouri[11]. The result obtained from his study shows that:

"... demand appears to be much less elastic when substitute prices are omitted from the model" (Rosenthal, 1987:834).

The explanatory power variable *(r-squared)* also increases and is highly significant by including the substitute sites in the demand models. The study also found that a model, which omits the substitute sites prices, results in larger estimates of consumer surplus than the two models.

(iii) Environmental Quality and Congested Level (Cg)

Environmental Quality

Another factor, which may be considered in determining the demand model, is the environmental quality. This topic encompasses a wide scope that might

[10] See appendix A

differentiate one site from the other. Two main features belonging to the environmental quality are various types of infrastructure related to the site and the sites congested level. In the standard TCM analysis, environmental quality will be taken into consideration if it influences a person's decision to visit one site over another.

The environmental infrastructure type, refers to the amenities provided by the sites to the visitors during their visit. At the same time, it can also be described as natural qualities belonging to the site, regardless of the site's indicator type. At the beaches, for example, cleanliness of the water and the amount of litter on the beach are more of concern, but at the fishing sites, the stock of fish is more significant.

Congested Level

Highly congested areas usually decrease the tendency of visitors to visit the place *per se* as well as reducing their economic benefit. However, it normally refers to the free public recreational park when no charges are imposed to the visitors. On the other hand, preferences of congested area depend on individuals' perception.
In the context of TCM, there is no single study that attempts to test the impact of the environmental quality on the demand of visits. In his study, McConnel (1977) raised a direct approach, which is more appropriate to the CVM on the impact of

[11]The study, which represented 60,000 users, is purposely made to determine how much can the estimated consumer surplus affects the way in which substitute recreation sites are incorporated into the TCM.

environmental quality (congested recreation site) on the Rhode Island beaches. McConnel (1977) suggested using a 'yes' or 'no' question rather than be given a subjective response from respondents. The responses from respondents on the particular questions are best conceived as a per unit measure of consumer surplus[12]. Again, two questions arise here: how to reveal visitors' preferences (individuals' perceptions) toward congestion and on what tools should be used to measure the congestion.

(iv) Socio-Economic Characteristics (S)

The inclusion of the socio economic characteristic variable is not just to elicit the pattern of visitor's behaviour (income, education and age) but it will also be used to calculate the consumer surplus. This is because the socio-economic characteristic variable will be considered as a constant term whereas the travel cost will be considered as the dependent variable (trips).

Thus, the derivation of trip generating function (TGF) can be estimated as a function of cost (C), substitute sites (SS), congestion (Cg) and socio economic (S) characteristics, this is stated as below:

$$V = f(C, SS, Cg, S)$$

where:

V is visits per individual or visits per zones.

[12] Since the respondents are willing to pay higher than the existing cost, it is considered as a consumer surplus

c. Visit Per Annum (VPA) and Visit Per Capita (VPC)

When the cost function is agreed upon, the trip generating function (TGF) can then be formed. Visits are taken as a function of cost, substitute sites and socio-economic characteristics. There are two options to this exercise which are either to use visits per individual or visits per zones (according to some natural breakdown of the area surrounding the site). If individuals give the number of visits in that particular year, the dependent variable is called visits per annum (VPA). If the number of visits is taken based on individuals from a particular zone, it is known as visit per capita (VPC that is visit / zonal population).

In order to have reasonable sample size, the zones of origin may need to be quite small, in which case travel cost may not be suitable if used in the statistical model. Another problem with the zonal model is that some of the independent variables may need to be aggregated across the zones' population so that the cost can be calculated. If the problems occur, it may increase the error or decrease the likelihood of finding any significant features from the study.

The question that arises is whether this model is compatible with the individual utility maximization approach. As all relevant data must be collected from each visitor, many believe that the individual model is more dominant, but necessitates a more labour-intensive data collection process.. A Study by Willis and Garrod

(1991) found that the different types of dependent variable would give a significant impact on consumer surplus estimation. It was stated that:

".....using individual visits per annum (VPA) instead of zonal visits reduced the non-market recreation value of UK estate of the Forestry Commissions from £53.00 million to £8.66 million" (Hanley and Spash, 1993:87).

In the zonal travel cost method (ZTCM), the travel cost expenditure from different origin zones is regressed against per capita visitation rates from each zone (Willis and Garrord, 1991). But Brown and Nawas (1973) stated that the method will create problems concerning: (1) multicollinearity, (2) specification bias, (3) heterogeneity of participants and (4) strong negative bias due to complicating factors of travel time (Gum and Martin, 1975)

d. Output of TGF

Once a TGF has been estimated using multiple regressions, a demand relationship is estimated by simulating what would happen to visit per annum (VPA) or visit per capita (Visit/Zonal Population) as the fee is increased. In this way, a demand curve is drawn out for each site.

The fee will increase until visits are reduced either to zero or less than one (depending on the functional form of TGF). This is shown in Figure 3.1 where total

existing visits are Qt. The TGF is used to draw out the demand curve which shows the number of visits that will be made to the site as long as the cost of the visit stays below P*.

The configuration of the demand curve depends on whether the functional form is linear, semi-log (dependent), semi log (independent), log-log or quadratic. The choice of functional form is important because it will lead to a significant impact on the consumer surplus estimation from the same data set.

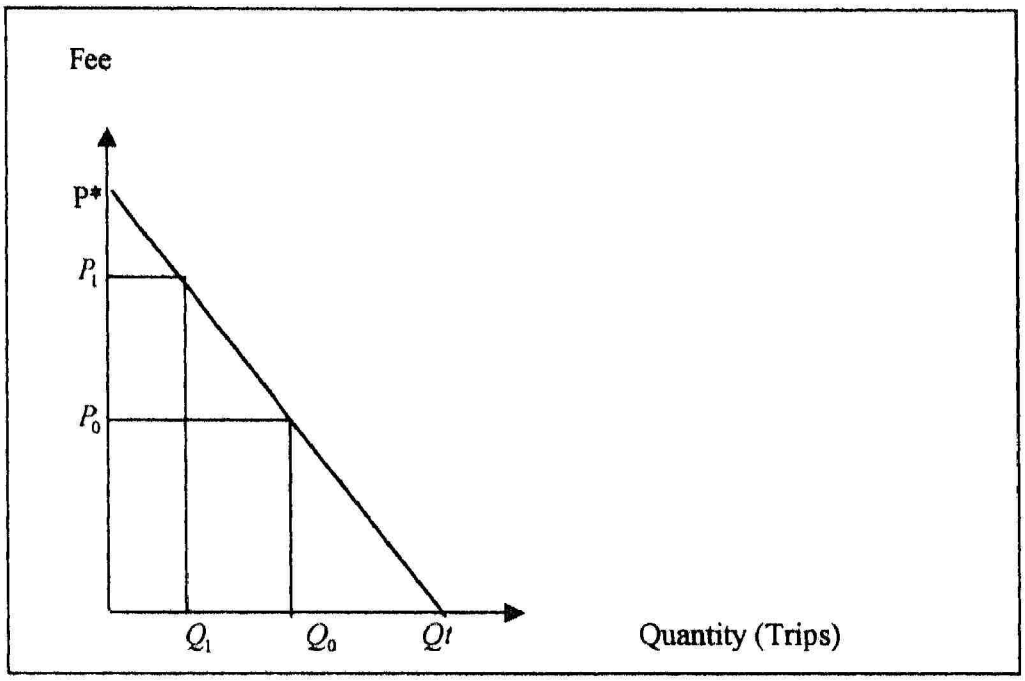

Figure 3.1: A linear demand curve for visits.

In his study of bird watching and fishing recreation at Kuala Gula, Taiping, Perak, Redzuan Othman (1999) found that the consumer surplus from linear function is higher compared to the semi-log (dependent) model. Consistent results can also be examined by using different equations as done by Mohd Shahwahid (1999) where the consumer surplus estimation ranges minimally within each functional form.

Normally, only two kinds of functional forms are adopted for the consumer surplus estimation, namely the linear and semi-log (dependent) model. In order to estimate the consumer surplus for both models, an area under the demand curve is used for the linear model while the ratio of the expected number of trips taken with the coefficient of travel cost is assigned to calculate the consumer surplus for the semi-log (dependent) model.

Instead of using the expected trips taken in semi-log (dependent) model, Gum and Martin (1975) suggested the use of the actual trips taken, which was valued as one. In a normal study, statistical significance which is shown with a high value of *r-squared* and *a priori* as well as following ordinary least squares (OLS) assumptions[13], are the most important factors that should be considered before deciding the form of the function (TGF).

Since the data are related to the cross-sectional type, the problem of heterocedasticity is unavoidable. However, this problem does not give any significant impact on the coefficient variables except for its standard error, which might lead to the insignificance of the result. High correlation between socio economic characteristics such as years of schooling (education) and monthly income (RM / per month), which is a partial correlation between the independent variable, may result in a multicollinearity problem. But the problem of multicollinearity could be ignored if the objective of the study is only for prediction.

[13] BLUE property, Best, Linear, Unbiased and Estimator